

CRUSHED STONE JOURNAL



DECEMBER 1960

OFFICIAL PUBLICATION OF THE NATIONAL CRUSHED STONE ASSOCIATION



LET'S GO!

44TH

ANNUAL CONVENTION

NATIONAL CRUSHED STONE ASSOCIATION

EXECUTIVES



HEAR —

**TIMELY AND INFORMATIVE DISCUSSIONS ON
PROBLEMS OF PARTICULAR SIGNIFICANCE
TO YOU**

**OPERATING
MEN**



PARTICIPATE —

**ASK QUESTIONS AND SHARE YOUR EXPERI-
ENCE DURING THE MANY DISCUSSION
PERIODS**

SALESMEN



JANUARY 17-20, 1961

AMERICANA • Bal Harbour, Miami Beach, Florida

Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

VOL. XXXV No. 4

PUBLISHED QUARTERLY

December 1960

NATIONAL CRUSHED STONE ASSOCIATION



1415 Elliot Place, N. W.
Washington 7, D. C.

OFFICERS

G. D. LOTT, JR., President
CHARLES COBURN, Vice President
J. R. CALLANAN, Treasurer
J. R. BOYD, Executive Director
J. E. GRAY, Engineering Director

REGIONAL VICE PRESIDENTS

ABNEY BOXLEY	A. W. HEITMAN
A. N. FOLEY	J. L. HOLDEN
D. C. HARPER	M. E. McLEAN
R. G. L. HARSTONE	A. W. McTHENIA
B. G. WOOLPERT	

EXECUTIVE COMMITTEE

G. D. LOTT, JR., Chairman	
O. E. BENSON	J. L. HOLDEN
CHARLES COBURN	M. E. McLEAN
W. P. FOSS	W. D. MILNE
G. D. FRAUNFELDER	W. C. ROWE
D. C. HARPER	D. L. WILLIAMS

EDITOR

J. R. BOYD

Contents

	Page
Impressive Program Completed for Miami Beach Convention	3
Limestones with Excellent Non-skid Properties By J. E. Gray and F. A. Renninger	6
Record Attendance at NCSA Eighth Engineering Conference	12
J. Harper Fulkerson—In Memoriam	14
Cover Photographs Wanted for the Crushed Stone Journal	15
Manufacturers Division Directory	16

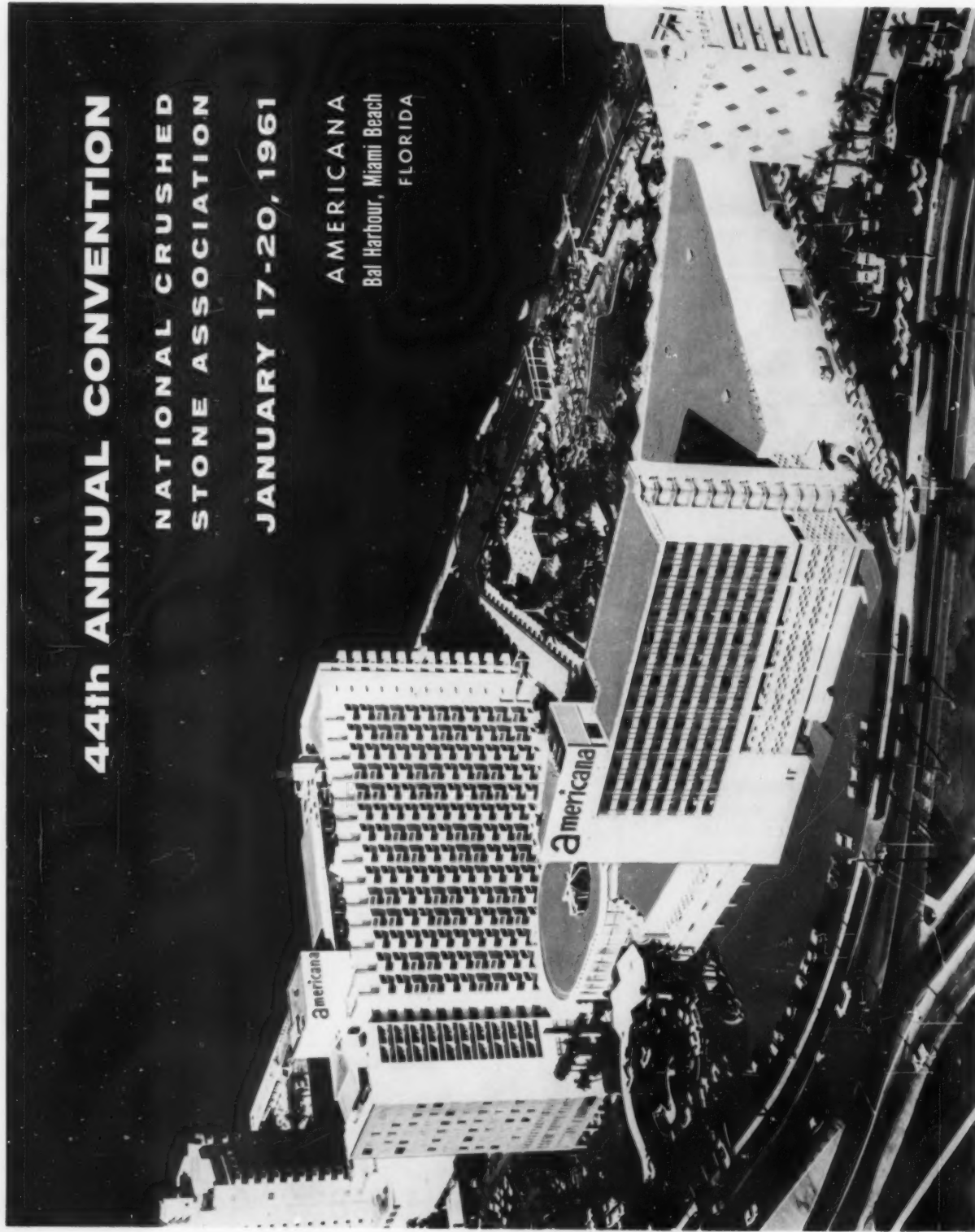
Cover Photograph — Upton Quarry of Kentucky
Stone Company, Louisville, Kentucky

44th ANNUAL CONVENTION

NATIONAL CRUSHED
STONE ASSOCIATION

JANUARY 17-20, 1961

AMERICANA
Bal Harbour, Miami Beach
FLORIDA



Impressive Program Completed for Miami Beach Convention

Advance Reservations Indicate Excellent Attendance

PROGRAM arrangements for the 44th Annual Convention of the National Crushed Stone Association are now complete. Crushed stone producers and equipment manufacturers from all sections of the United States and Canada will participate in this traditionally outstanding NCSA event of the year.

Scheduled to take place at the Americana, Bal Harbour, Miami Beach, Florida, on January 17, 18, 19, and 20, 1961, this meeting promises to be one of the most stimulating, informative, and entertaining ever held in the long history of successful NCSA Annual Conventions. No segment of the crushed stone industry has been overlooked in the careful development of the subjects to be presented. Executives, operating men, and salesmen—each will find much of direct appeal in the special sessions and in the well planned general sessions which will feature subjects of universal interest to the entire industry. In addition there will be an invaluable opportunity for personal contacts between quarrymen and the technical representatives of equipment manufacturers who will be on hand to consult and advise on individual operating problems.

General Sessions

Tuesday morning, January 17, the 44th Annual Convention of NCSA will get under way with the first of two "top-notch" general sessions. Following a motion picture, NCSA President George D. Lott, Jr., President of Palmetto Quarries Company, Columbia, South Carolina, will extend greetings to the Convention. Following President Lott, NCSA Executive Director J. R. Boyd and Engineering Director J. E. Gray will present "Highlights of NCSA Activities in 1960." Rounding out the morning program, Dr. Leonard Obert, Chief, Applied Physics Laboratory, U. S. Bureau of Mines, College Park, Maryland, will discuss "Recent Developments of Bureau of Mines Investigations of Vibrations from Quarry Blasting." This is a subject of great importance to all quarry operators as it deals with the cooperative program

being spearheaded by the Bureau of Mines to revise and update the Bureau's Bulletin No. 442.

The next general session will take place Friday morning, January 20. As the final session of the Convention it will include talks on: "Highway Needs—Today and Tomorrow," by Erskine Stewart, Vice President, Better Highways Information Foundation, Washington, D. C.; "Profits From Ideas on Your Job," by Dr. Herbert True, Director of Creativity Research, Visual Research, Inc., Chicago, Illinois.

Greeting Luncheon

One of the Convention's many highlights will be the Greeting Luncheon on Tuesday, January 17. The newly elected NCSA officers and Executive Committee will be introduced by President Lott; following which James Westfield, Assistant Director of Health and Safety, U. S. Bureau of Mines, Washington, D. C., will present the much coveted and hard-won 1959 NCSA Safety Awards, and Dr. Pierce Harris, Pastor, First Methodist Church, Atlanta, Georgia, will give a philosophical and humorous talk on "A Working Creed for a Changing World." Dr. Harris' interests are many as he is a man of prodigious energy. Probably he is best known for his column which has appeared in the Atlanta Journal since 1943. Reader interest polls show his column to be one of the most popular and widely read in the entire history of the paper.

Two Operating Sessions Scheduled

The 44th Annual Convention offers two special operating sessions containing a tremendous amount of information of real and practical value to operating men and manufacturers of equipment and machinery. The first of these sessions will be held on Wednesday morning, January 18, and will cover a variety of topics selected from suggestions submitted by operating men.

The session will open with an important and interesting panel discussion dealing with "Poli-

cies and Procedures for Maintenance and Repair of Quarry Equipment." Each of the three panelists will discuss the subject from a specific point of view. "Lubrication," will be handled by W. H. Ruby, Chief Engineer, Acme Limestone Co., Fort Spring, West Virginia; "Fixed Equipment," by J. A. Carnathan, General Manager-Operations, Birmingham Division, Vulcan Materials Co., Birmingham, Alabama; and "Portable Equipment," by C. F. Stetser, General Superintendent, New York Trap Rock Corp., West Nyack, New York.

Following a coffee break, Dr. B. J. Kochanowsky, Professor, Department of Mining, College of Mineral Industries, Pennsylvania State University, University Park, Pennsylvania, will discuss a subject of increasing interest to quarry operators in his talk on "Inclined Drilling," and Montagu Hankin, Jr., Vice President-Operations, Houdaille Construction Materials, Inc., Morristown, New Jersey, will present possible solutions to a problem faced by many quarry operators in his paper "Effective Methods of Dust Control."

The always helpful discussion period has been scheduled following each presentation. However, experience has shown that time usually does not permit, during these limited periods, the discussion of many of the specialized problems which are so important. With this thought in mind, the tremendously popular round table sessions, first tried at the Miami Convention two years ago, will be repeated at the coming Convention on Thursday morning, January 19.

As before, this session will consist of a series of concurrent round table discussions. Each of the speakers from the first operating session will be present at a table to discuss in greater detail questions on the subjects covered in their talks. In addition to the subjects from Wednesday's operating session, there will be other round tables on a variety of subjects of equal interest and importance.

Those attending are free to select and actively participate in as many of these round table discussions as their time and interests dictate. There will be 10 tables in all—one on each of the following subjects: Accident Prevention, Blasting Vibration Studies, Drilling, Dust Control, Lubrication, Policies and Procedures for Maintenance and Repair of Fixed Equipment, Policies and Procedures for Maintenance and Repair of Portable Equipment, Repair and Replacement of Parts That Wear, Water and Waste Solids Disposal Systems,

and Rubber Tired Equipment in Quarry Operations.

Plan to bring your ideas and questions to this unique give-and-take session—one idea could well provide the answer to a difficult operating problem.

Special Session for Salesmen

At no other time during the year will salesmen have a better opportunity to hear and discuss how sales problems, similar to their own, are solved by other men and companies. This session, which will be held Wednesday morning, January 18, will consist of a number of thought-provoking subjects presented by speakers chosen because of their special knowledge and recognized ability. Opening the session will be T. C. McPoyle, Sales Manager, D. M. Stoltzfus & Son, Inc., Talmage, Pennsylvania, with his subject "The Salesman and His Product." Then Edmund Clark, Treasurer, Munnsville Limestone Corp., Munnsville, New York, will present some interesting aspects of sales in his talk "The Salesman's Role in Public Relations." The problems of "The Salesman's Role in Coordinating Sales and Delivery," will be discussed by L. B. Lovett, General Sales Manager, Camp Concrete Rock Co., Ocala, Florida, and Reve Eckman, Credit Manager, National Lime and Stone Co., Findlay, Ohio, will follow with "The Salesman's Role in Collecting Delinquent Accounts." To complete the morning V. G. Aubry, Jr., Vice President in Charge of Sales, Houdaille Construction Materials, Inc., Morristown, New Jersey, will talk on "The Effective Use of Salesmen's Reports to Management."

It can readily be seen that this imposing program of the special session for salesmen offers a wealth of information and practical know-how. Everyone involved in this phase of the crushed stone industry should plan to attend.

General Luncheon

Members and guests attending the General Luncheon on Wednesday, January 18, will hear Jim Buchanan, a self described "sometimes foreign correspondent," of the Miami Herald. He covered the first major fighting of the revolution in Cienfuegos, Cuba, in 1957, the "false uprisings" in Havana, and innumerable small skirmishes between the Cuban Army and Castro's rebels. For more than two weeks he lived with the insurgents in the Sierra Cristal Mountains and with another reporter found the 31 American

sailors Raul Castro had captured and hidden in the hills.

Mr. Buchanan's adventures and exploits were brought to an abrupt end as the result of his critical writings on Cuban politics. Tried before a midnight session of one of Fidel Castro's military tribunals, he was convicted and sentenced to a 14 year prison term and told punishment would be suspended if he left the country within 24 hours. Needless to say, he departed. His comments on political affairs in Cuba and the Caribbean area will be of real interest to all.

Two Sessions for Executives

On Wednesday afternoon, January 18, John F. Lane of Gall, Lane and Howe, Washington, D. C., NCSA General Counsel, will present several subjects of particular significance to the crushed stone industry in the first of two special sessions for executives.

The quest of company executives for accurate information as to the proper treatment of important tax matters is as never-ending as the relentless quest of the federal government for tax dollars. At this session Mr. Lane will give particular emphasis to the following problems: Percentage Depletion, Depreciation, and Business Entertainment Expense.

On Thursday morning, January 19, Mr. Lane will conduct the second session for executives. With the rapidly expanding federal highway program, the crushed stone industry has become increasingly confused regarding the frequently overlapping impact of the numerous federal statutes establishing wage-hour and other standards governing the industry's work force. The purpose of this session is to allay some of the uncertainty and to inform participants of possible remedies for the unusually difficult problems in this area.

Manufacturers Division Luncheon

The Manufacturers Division Annual Luncheon, for members of the Division only, will be held on Thursday, January 19. The newly elected Officers and Executive Committee of the Division will be introduced and members brought up to date on the activities of the Division. All representatives of associate member companies of NCSA are cordially invited and urged to attend.

A Night in the Tropics

One of the highlights of every NCSA Convention is "party night." This year the theme for this

festive occasion will be "A Night in the Tropics." The party will be held under the stars around the beautiful Americana pool.

A variety of cuts of roast beef and all the "trimmings" will be served from a number of serving huts placed strategically around the dining area. Only those NCSA members and guests who have attended one of these spectacular events at the Americana before can have any conception of the wonderful food and the beauty of the setting. The evening's entertainment will be in keeping with the general theme. Planned with the assistance of NCSA Entertainment Counsel, Jack Morton, the show will feature a variety of unique top-notch entertainers. Throughout the evening, members and guests are invited to dance to the delightful music of two orchestras and otherwise enjoy themselves at "A Night in the Tropics."

For the Ladies

An appealing and interesting program is planned for the many ladies who will attend the Convention. A special Ladies Headquarters will be open throughout the Convention period where capable and gracious member hostesses will assist all to thoroughly enjoy themselves. Each morning there will be a friendly get-together for coffee providing an ideal opportunity to discuss and make plans for the day's activities. Of particular interest will be the "Cheerio Tea" on Monday and the special Ladies Luncheon on Thursday at which there will be a unique speaker with many surprises, brought from New Orleans, Louisiana, specially for this luncheon. Much of the general Convention program will be of interest to the ladies, such as the luncheons on Tuesday and Wednesday, and of course the party on Thursday night. Aside from Convention events, there is much for the ladies to do and see in the Miami Beach area. Sports, sightseeing by land or sea, relaxing in the warm Florida sunshine, or exploring the many magnificent stores where unusual and imported gifts abound.

An excellent job in putting together the Convention program has been done by the NCSA Convention Arrangements Committee. The program which has been developed should prove both profitable and practical as well as completely enjoyable.

Make your plans now to be at the Americana, Bal Harbour, Miami Beach, Florida, January 17 through 20, 1961./NCSA

Limestones with Excellent Non-skid Properties

By J. E. Gray, Engineering Director
F. A. Renninger, Petrographer

National Crushed Stone Association
Washington, D. C.

DURING the past ten years there has been, among some engineers, a growing belief that limestone aggregates have been the cause of excessive slipperiness in some pavements. Since no method of test was readily available for determining whether or not a given limestone would become slippery, it became a practice in some areas of this country to forbid the use of limestone in the surface course of pavements.

Actually, the problem of slippery pavements has been studied in the NCSA Laboratory for several years. Realistic test sections are placed in a circular test track and their skid resistance is measured with a special device designed for this purpose. Both the circular test track and the apparatus for measuring skid resistance were fully described in the March 1959 issue of the *Crushed Stone Journal*.

While performing tests for skid resistance of bituminous paving mixes in the past, it has been observed that mixes containing some limestones develop excessively slippery surfaces after a relatively small amount of rubber tire traffic, while other limestone mixes exhibit excellent non-skid properties and retain these properties during extended periods of rubber tire traffic. Quite naturally, the question arose as to what properties of these limestones would cause one to provide good skid resistance while another became slippery. It is, therefore, the purpose of this article to present the results of a study that was made in an effort to answer this question.

Limestone Defined

First, it may be well to define limestone as it is used here, and the following definition is particularly applicable to the problem at hand.

"Limestone is a sedimentary rock in which the carbonate fraction exceeds the noncarbonate fraction and in which the predominating metallic element of the carbonate is calcium."

Thus, by definition, limestone may vary over a wide range in mineral composition and, by defini-

tion, each of the following rocks would be considered a limestone:

1. Pure calcite with 100 per cent calcium carbonate and a Mohs hardness of 3
2. Argillaceous limestone with 51 per cent calcium carbonate, 49 per cent clay, and a Mohs hardness of 3
3. Siliceous limestone with 51 per cent calcium carbonate, 49 per cent disseminated silica, and a Mohs hardness of between 3 and 7
4. Cherty limestone with 51 per cent calcium carbonate, up to 49 per cent chert nodules, and a Mohs hardness between 3 and 7

Although each of these rocks would be called a limestone, it is quite evident that they differ widely in mineral composition and hardness. One might also suspect that they would differ in their polishing characteristics.

Determination of Slipperiness

For this program of tests, five limestone aggregates, each from a different source, were selected for inclusion in bituminous concrete mixes. The bituminous mixtures themselves were designed by the Marshall procedure to comply with the specifications applicable to the various states from which the aggregates were obtained. The mixes were placed in the NCSA circular track, then rolled, first with a heavy steel roller and then by a pneumatic tire roller. After thorough compaction, the test sections were subjected to thousands of passes of a wheel equipped with a rubber tire. Initially, water and fine sand were placed on the surface of the test sections as an aid to the rubber tire in wearing away the asphalt and exposing the aggregate. Later the surfaces of the test sections were cleaned and dried and the traffic was continued, using only the rubber tire so as to polish the exposed aggregate.

At appropriate intervals measurements of the slipperiness of the five test sections were made

using the wheel slipperiness testing machine. Readings with this device are reported as degrees of angle of rotation. These angle values obtained with the wheel have been related to coefficient of friction values obtained with skid car stopping distance tests through correlation studies. Continuous calibration of the wheel is maintained by periodic tests of glass plate "standards of slipperiness."

Since the AASHO curve for coefficient of friction values for calculating stopping sight distances shows a value at 40 mph of 0.325, a coefficient of friction of 0.4 has been selected as the dividing point between surfaces possessing adequate skid resistance and those having poor skid resistance. At the time of these tests a slipperiness measurement of 73 degrees with the NCSA wheel approximated a coefficient of friction of 0.4. The higher the wheel angle reading in degrees, the more slippery the surface.

The gradations of the five aggregates studied and the mix composition of the test sections are shown in Table I. The coarse and fine portions

TABLE I
AGGREGATE GRADATION AND MIX COMPOSITION

Aggregate Identification	A	B	C	D	E
Gradation of Aggregate					
Total per cent passing					
1/2 in.	100	100	100	100	100
3/8 in.	99	90	90	95	95
No. 4	83	60	60	66	75
No. 10	64	42	42	46	50
No. 40	21	18	18	18	17
No. 80	11	9	9	11	10
No. 200	6	6	6	6	7
Asphalt, per cent	6.5	5.3	5.5	6.5	6.5
Slipperiness, wheel angle degrees	52	51	79	39	89

of each aggregate were both from the same parent rock. This table also presents the final wheel angle reading for each of the test sections after the polishing traffic was completed.

It is quite evident that, although all of the aggregates used were limestones, the five bituminous mixtures differ widely in skid resistance. Mixes containing aggregates C and E with wheel angle values of 79 and 89, respectively, would be called excessively slippery, while mixes containing aggregates A, B, and D with wheel angle

values of 52, 51, and 39, respectively, possess good or even excellent skid resistance. For purposes of comparison, sand asphalt mixes containing natural sand and slag mixes with natural sand or slag fines are both reputed to have good non-skid properties. Natural sand mixes tested in the NCSA Laboratory in the past have exhibited slipperiness values between approximately 40 and 55 degrees, while slag mixes have ranged from about 58 to 63 degrees.

Rate of Polish

As was stated previously, mixtures containing certain limestones polish quite readily with very little traffic while other mixtures containing different limestones do not polish or polish very little during extended periods of traffic. This statement is amply supported by Figure 1. There is little doubt that after 10,000 passes of polishing traffic with the rubber tire, test sections containing limestone aggregates C and E had become excessively slippery. But test sections containing limestone aggregates A, B, and D did not polish even after 40,000 passes of the rubber tire.

The question was raised during the conduct of another similar series of tests as to what criteria or what method was used to determine just when the polishing traffic should be discontinued. Ordinarily the tests are discontinued when the curve formed by plotting wheel angle vs number of passes of polishing traffic levels off or becomes essentially horizontal. This usually occurs before 40,000 passes of the rubber tire. It seems reasonable to assume that at such a point a more or less static condition of slipperiness has been reached. To ascertain that such is the case, a test was made wherein the polishing traffic was continued until the test sections had been subjected to a total of 95,000 passes of the rubber tire. Figure 2 shows that very little additional polishing is achieved during the latter 55,000 passes. The use of the wheel angle readings obtained after 40,000 passes of the tire to indicate the ultimate value for the slipperiness of these bituminous mixtures under the conditions of test is perfectly valid due to the fact that they fall within one standard deviation of the values obtained after 95,000 passes. The dotted bands in Figure 3 are the standard deviation limits of the readings made after 95,000 passes for each of the test sections shown.

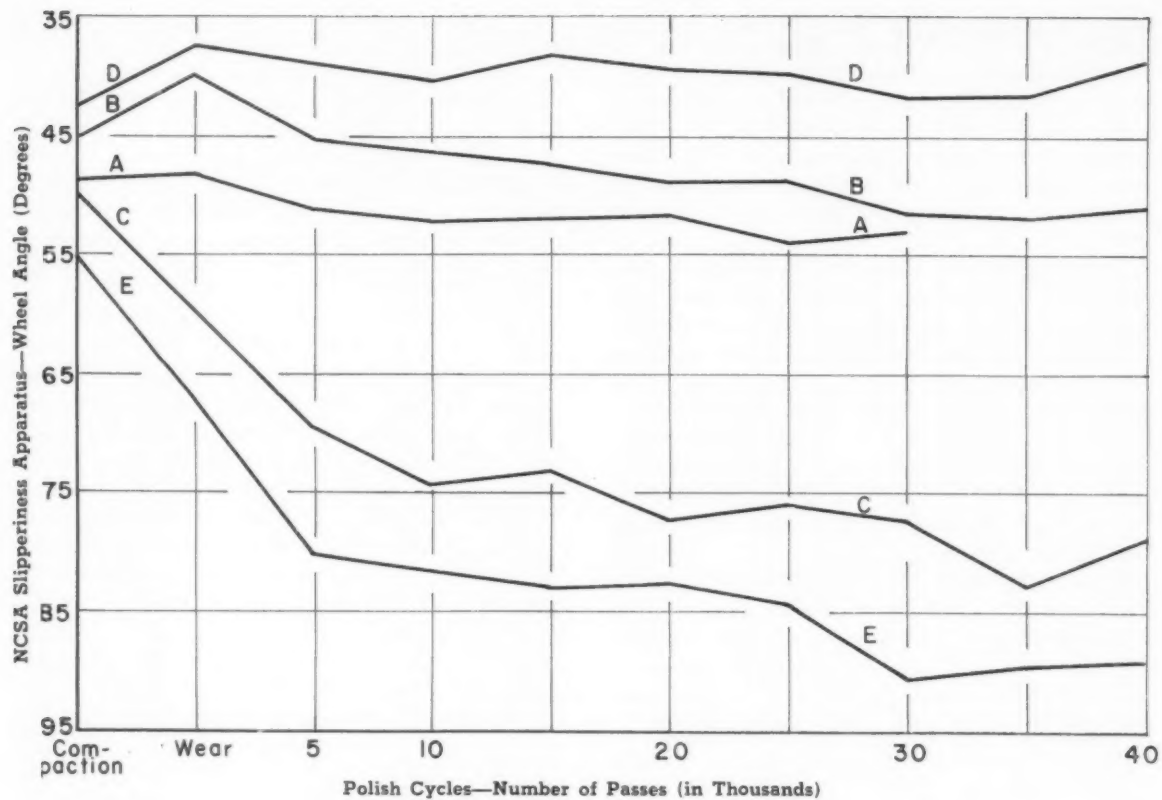


FIGURE 1
Rate of Polish

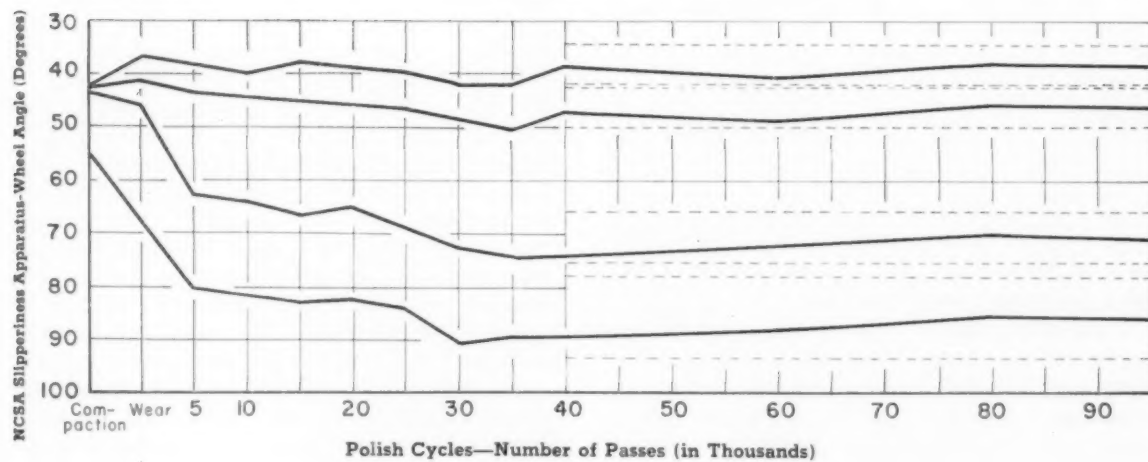


FIGURE 2
Effect of Amount of Traffic on Slipperiness

Method of Studying Limestone Characteristics

In attempting to answer the question of why some of these limestones polish and become slippery while others do not, it was necessary to develop some systematic procedure for studying these rocks that would reveal what was considered to be some of their basic properties. First of all, the samples for study were representative samples from stockpiles of commercially produced stone which included material from the entire working face of the various quarries. After some exploratory tests, the following procedure was adopted for the study:

1. Samples of each of the five aggregates, representative of their respective gradings as used in the bituminous mixes for slipperiness tests, were selected
2. Each of the samples was leached with a dilute solution of hydrochloric acid until the soluble carbonates had been dissolved
3. Portions of the samples remaining after leaching were filtered, washed, dried, and weighed, and the percentages of carbonates and insoluble residue were calculated
4. The insoluble residue of each of the five aggregate samples was tested for grain size

distribution by ASTM Method of Test D 422 and for specific gravity

5. An approximate determination of the mineral composition of the insolubles from each aggregate was made by microscopic examination

Results of the tests for insoluble residue and grain size analysis of the insolubles, Table II, shows to some extent the heterogeneous nature of limestones as a group. Classification of the insoluble residue as a percentage of the total aggregate, using a soils classification of sand, silt, and clay, has also been given in this table. The insoluble residue coarser than the silt or 0.05 mm size was studied microscopically for a determination of mineral composition and the results of these studies are tabulated in Table III.

Influence of Limestone Characteristics on Slipperiness

Limestone C which proved to be quite slippery in these tests is a siliceous limestone containing approximately 25 per cent insolubles. However, approximately 40 per cent of these insolubles were very fine.

Limestone E was the most slippery of the five aggregates tested. This limestone also happens

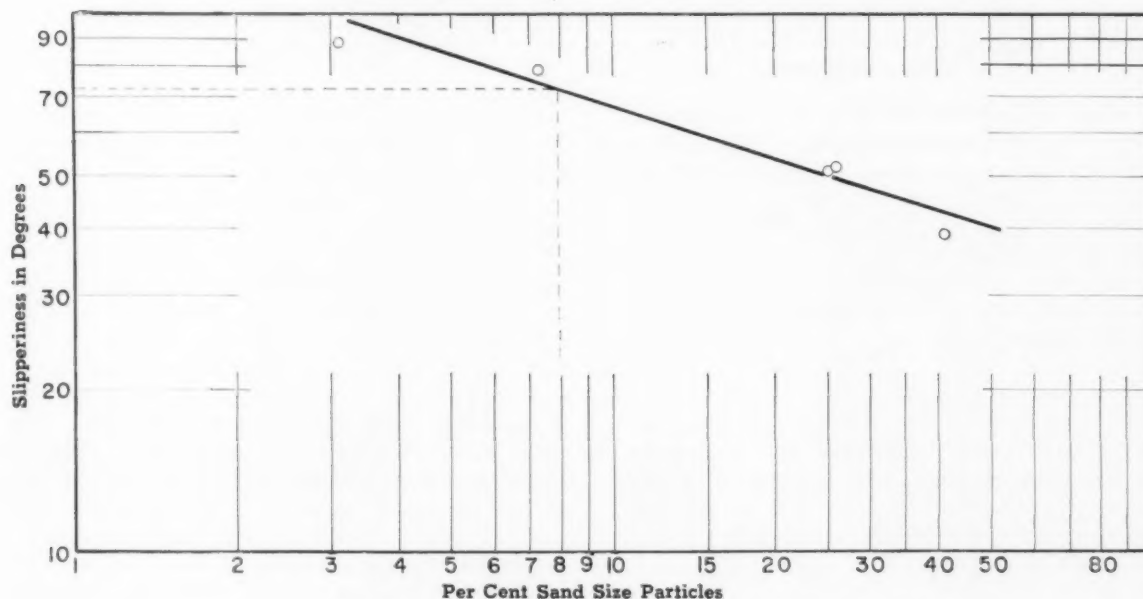


FIGURE 3
Relationship Between Slipperiness
and Amount of Insoluble Sand Size Particles

to have the smallest percentage of insolubles, 9 per cent, and again a large portion of these insolubles was very fine material in the silt and clay size.

Thus, of the five limestones tested, two were quite slippery, one had only a small portion of insolubles while the other contained an appreciable amount of insolubles. So it can not be said that the amount of insolubles alone controls the slipperiness of the aggregate. A point in common to both aggregates, however, is the fineness of the insoluble residue. The grain size analysis of the insolubles of both materials approaches that of an argillite. This might be an indication that the very fine siliceous material does not effectively contribute to skid resistance.

Limestones A and D were both arenaceous and both had good skid resistance. Limestone A had 42 per cent insolubles which consisted primarily of sand size grains of quartz, mica, and feldspar. The insoluble content of Limestone D was 48 per cent and was composed almost entirely of sand size grains of quartz.

It would appear then, from the tests on Lime-

stones A and D, that amount of insolubles does influence—but not control—the slipperiness of aggregates. Furthermore, there is evidence that it is the sand size grains of the insolubles that are effective in promoting skid resistance. One might imagine that an aggregate with 48 per cent insolubles, most of which was sand size grains of quartz, would have the appearance and texture of a coarse sandpaper—providing the carbonate fraction was sufficiently soft so as to wear away and leave the quartz particles exposed. And actually, Limestone D did have such an appearance and texture after being subjected to rubber tire traffic.

Limestone B, which also had good skid resistance, was somewhat unusual. The insoluble residue of this aggregate was 36 per cent and consisted of 26 per cent mica and only 10 per cent quartz. The mica, which is one-half point softer than limestone on the Mohs scale of hardness, has a grain size analysis quite similar to that of the insolubles of Limestone A and the skid resistance of bituminous mixtures containing these two aggregates is almost the same. It would seem,

TABLE II
GRADATION AND SIZE CLASSIFICATION OF INSOLUBLE RESIDUE

Aggregate Identification	A	B	C	D	E
Slipperiness					
NCSA wheel angle, degrees	52	51	79	39	89
Carbonate, per cent	58	64	75	52	91
Insoluble Residue, per cent	42	36	25	48	9
Specific Gravity of Insolubles	2.65	2.65	2.65	2.65	2.57
Grain Size of Insoluble Residue					
Total per cent finer than					
3/8 in. — 9.52 mm	100	100	100	100	100
No. 4 — 4.76 mm	91	94	81	100	100
No. 10 — 2.00 mm	78	85	69	98	94
No. 40 — 0.42 mm	47	63	52	94	85
No. 60 — 0.25 mm	39	51	48	78	81
No. 80 — 0.177 mm	33	42	47	64	78
No. 200 — 0.074 mm	21	25	41	18	66
— 0.05 mm	14	14	40	15	60
— 0.005 mm	2	2	16	8	20
Size Classification of Insolubles					
Per cent of Total Aggregate					
Coarse Aggregate +2.0 mm	10	6	8	1	0
Coarse Sand 0.25 to 2.0 mm	16	12	5	10	1
Fine Sand 0.05 to 0.25 mm	10	13	2	30	2
Silt 0.005 to 0.05 mm	5	4	6	3	4
Clay — 0.005 mm	1	1	4	4	2
Total	42	36	25	48	9

TABLE III
IDENTIFICATION OF AGGREGATE BASED ON ITS APPROXIMATE
MINERAL COMPOSITION

Aggregate Identification	Approximate Mineral Composition	Per Cent	Name
A	Carbonates	58	Arenaceous Limestone
	Quartz	17	
	Mica	11	
	Feldspar	10	
	Clay Minerals Carbonaceous Material	4	
B	Carbonates	64	"Mica Rich" Siliceous Limestone
	Quartz	10	
	Mica	26	
	Magnetite	Trace	
C	Carbonates	75	Grey Siliceous Limestone
	Quartz	25*	
	Mica		
	Clay Minerals		
D	Carbonates	52	Arenaceous-Quartzitic Limestone
	Quartz	47	
	Mica	1	
	Carbonaceous Material		
E	Carbonates	91	Grey Limestone
	Minor fraction (Minor fraction probably composed of quartz, mica, feldspar, and clay —impossible to distinguish under 30x)	9*	

* Individual percentages not readily distinguished. Minerals very minute and earthy in appearance. Grain size of insolubles approaching that of an argillite.

therefore, that skid resistance is not indicated solely by hardness of the minerals of an aggregate but rather by a differential in the hardness of the mineral constituents. The following is quoted from a recent paper on "The Polishing of Roadstones," by Maclean and Shergold*: "The petrological characteristics that determine whether a stone will polish or not under pneumatic tyred traffic are not known, but it is suggested that one important characteristic of rocks that remain rough is the presence of two minerals that have a characteristic difference in their resistance to wear." Thus, other researchers have also noted that differential in hardness of the various mineral constituents is an important property of non-polishing stone.

It is questionable, however, whether differential hardness in itself is the essential property, be-

cause these data seem to indicate that it is the combination of differential hardness, amount of insoluble residue, and grain size distribution of the insoluble residue that determines the skid resistance of limestone aggregates. Certainly the presence of even appreciable quantities of hard minerals in the silt and clay size range does not impart non-skid properties to rock as evidenced by Limestone C in which appreciable quartz is present in these sizes.

Although the data reported herein is very meager—one limestone with excellent skid resistance, two with very good skid resistance, and two with poor skid resistance—it is believed that some of the more important characteristics necessary for good skid resistance in limestones have been determined. In Figure 3 is shown a plot of slipperiness (NCSA wheel angle) vs per cent of sand size particles contained in the insoluble

* "The Polishing of Roadstones in Relation to Their Selection for Use in Road Surfacing," D. J. Maclean and F. A. Shergold, Journal, Institute of Highway Engineers, 1959

(Continued on Page 15)

Record Attendance at NCSA Eighth Engineering Conference

THE National Crushed Stone Association held its Eighth Engineering Conference on October 10, 11, and 12, 1960; at the Mayflower Hotel in Washington, D. C. The Conference, under the direction of NCSA Engineering Director J. E. Gray, broke all previous attendance records and left little doubt as to the popularity of this Association activity. Indeed the record attendance of 187 persons places emphasis on the desirability of the continuation of these meetings as a means of disseminating the very latest technical information. The 187 persons present for the Conference represented 44 member companies, several state highway departments and government bureaus, various state crushed stone associations, and other organizations whose interest is closely allied with that of this Association's members.

Purpose

These Conferences were originally planned for the purpose of providing the crushed stone salesmen with the technical information needed to best serve the consumer and effectively promote the sale of crushed stone. However, it has become more and more evident with each succeeding Conference that these meetings are equally in-

formative to the engineers, to the production men, and to the top executives of the industry.

The salesman gains a better understanding of the technical problems confronting the engineer, a working knowledge of test procedures, and a more extensive comprehension of the "why's" of various specifications.

The engineers and production men benefit from the exchange of ideas and experiences with the speakers and others present who have knowledge of the problems they encounter. The solution for a particular problem is often found through just such an exchange of ideas and experiences.

The executive is aided in his estimate of trends in the industry by listening to speakers from government bureaus, state highway departments, or other agencies directly involved in the use of aggregates. He is well aware of the fact that the personal opinion and thinking of these leaders today could easily become policy tomorrow.

Program

A program of short, concise, off the record talks followed by discussion periods, all on an informal basis, stimulated the speakers, each an acknowledged expert in his field, to give free expression



Eighth Engineering Conference, National Crushed Stone Association, October 10, 11 and 12, 1960, Mayflower Hotel, Washington, D. C.

to his thoughts and opinions concerning his chosen subject. Those present pressed for more and more information during the discussion periods and the questioning, exploring, and probing was often renewed at the close of a session when informal groups gathered around the speakers—a weather vane of a highly successful meeting.

Subjects and Speakers

The speakers as they appeared on the program and their subjects were as follows:

- "Welcome"—G. D. Lott, Jr., President, National Crushed Stone Association; President, Palmetto Quarries Co., Columbia, S. C.
- "Rocks, Their Origin and Composition"—F. A. Renninger, Petrographer, National Crushed Stone Association, Washington, D. C.
- "Physical Testing of Stone"—Joseph E. Bell, Assistant to Engineering Director, National Crushed Stone Association, Washington, D. C.
- "Significance of Tests"—Donald O. Woolf, Chief, Concrete Section, Division of Physical Research, Bureau of Public Roads, Washington, D. C.
- "Stone Sand"—A. B. Cornthwaite, Testing Engineer, Virginia Department of Highways, Richmond, Va.
- "Selecting Aggregates for Concrete—Corps of Engineers Procedure"—William R. Waugh, Chief, Concrete Branch, Engineering Division Civil Works, Office of Chief of Engineers, Gravelly Point, Va.
- "Design of Concrete Pavements"—Phil Fordyce, Supervising Engineer, Paving Engineering, Paving Bureau, Portland Cement Association, Chicago, Ill.
- "Proportioning of Concrete"—Joseph E. Bell, Assistant to Engineering Director, National Crushed Stone Association, Washington, D. C.
- "Admixtures for Concrete"—George Werner, Highway Research Engineer, Division of Physical Research, Bureau of Public Roads, Washington, D. C.
- "Stone for Ready Mixed Concrete"—C. E. Proudley, Director of Engineering, Carolinas Ready Mixed Concrete Association, Raleigh, N. C.
- "Aggregates for Masonry Units"—Karl Nensewitz, Manager, Besser Technical Center, Alpena, Mich.
- "Subgrade Soils, Selected Soils, and Subbase"—Preston C. Smith, Chief of Soils Branch, Division of Physical Research, Bureau of Public Roads, Washington, D. C.
- "Use of Stone in the Chemical and Process Industry"—Wallace W. Key, Commodity Specialist, Branch of Construction and Chemical Materials, U. S. Bureau of Mines, Washington, D. C.
- "Properties of Asphalt"—J. York Welborn, Chief, Bituminous Branch, Division of Physical Research, Bureau of Public Roads, Washington, D. C.
- "Graded Aggregate Base Course Construction"—Technical film produced by NCSA covering the best of recent construction practices
- "Shape of Particle"—J. E. Gray, Engineering Director, National Crushed Stone Association, Washington, D. C.

"CBR Method of Design of Flexible Pavements"—Charles R. Foster, Coordinator of Research, National Bituminous Concrete Association, College Station, Texas

"Maryland Experience With Stabilized Plant Mixed Aggregate Bases"—William B. Greene, Soils Engineer, Maryland State Roads Commission, Baltimore, Md.

"Mixing and Laying of Asphalt Paving"—Donald D. Dagler, District Engineer, Atlantic-Gulf Division, The Asphalt Institute, Harrisburg, Pa.

"Influence of Physical Characteristics of Aggregates on Durability of Concrete"—George Verbeck, Manager, Applied Research Section, Portland Cement Association, Skokie, Ill.

"Federal Inspection on the Interstate System"—Harold Allen, Chief, and Carl A. Carpenter, Assistant Chief, Division of Physical Research, Bureau of Public Roads, Washington, D. C.

"National Crushed Stone Association Engineering Service to Members"—J. E. Gray, Engineering Director, National Crushed Stone Association, Washington, D. C.

All of the sessions, from President Lott's welcome on Monday morning to Engineering Director Gray's closing remarks on Wednesday afternoon, were attended with an enthusiasm seldom seen at an engineering meeting.

Laboratory Demonstrations

On Thursday the NCSA Laboratory held open house for those attending the Conference. The Laboratory was arranged so as to exhibit as much of the test equipment as possible and the Laboratory Staff was on hand to answer questions regarding test procedures and to give demonstrations as requested. Many first-time visitors to the Laboratory expressed amazement at the completeness of the equipment and at the variety of tests required in the evaluation of aggregates, concrete, and bituminous mixes. Repeated requests were made for demonstrations of the NCSA particle shape test for stone sand and of the NCSA bicycle wheel slipperiness test. Real interest was also shown in the new triaxial test equipment.

Lighter Side

On the lighter side, after the strenuous sessions during the day on Monday, an informal "Fellowship Hour" was held in the early evening that proved to be both relaxing and pleasant. Old friendships were renewed and new ones made as members and guests mingled in the festive atmosphere that prevailed.

(Continued on Page 15)



J. Harper Fulkerson
1890-1960

In Memoriam

It is with deep regret and sadness in our hearts that we record the death of J. Harper Fulkerson. The end came in Moses Taylor Hospital, Scranton, Pennsylvania, on October 17, 1960, after a brief illness.

Harper, as he was affectionately known to his host of friends in the crushed stone industry, began his business career as assistant to the Secretary-Treasurer of the Carbon Machine Company. From 1916 to 1924 he was associated with his father, C. W. Fulkerson, in the music business. He joined Cross Engineering Company in 1924 where he directed sales and product development policies, becoming Vice President in 1933 and President in 1947. He served in this capacity until his retirement in 1958, at which time the Cross Engineering Company became the Cross Perforated Metals Plant of the National-Standard Company.

In 1944, Mr. Fulkerson and Mildred C. Gill, both residents of Carbondale, Pennsylvania, founded

the Jay-Harper Company, a firm of marketing specialists covering all types of perforated metals, special types of machinery, rubber conveyor belting, grating, expanded metals, wire, and building products. He was President of this organization at the time of his death.

J. Harper Fulkerson rendered distinguished service to the Manufacturers Division of the National Crushed Stone Association. He was first elected to its Board of Directors in 1935 and served continuously until 1949. He served on its Executive Committee from 1936 to 1945 and was Vice Chairman of the Division from 1936 to 1940.

Mr. Fulkerson received the highest honor within the power of the Division to bestow, when in 1941 he was elected Chairman and served for three successive terms during the difficult years of World War II.

As a representative of the Manufacturers Division, Mr. Fulkerson served on the NCSA Board of Directors from 1941 to 1945 and on the NCSA Executive Committee from 1941 to 1943.

Mr. Fulkerson brought to the councils of NCSA a vigorous and active personality, always tempered by a consideration for others. He was constantly alert to the best interests of the National Crushed Stone Association and its Manufacturers Division in which he had so keen and lively an interest.

His attendance at the 1960 Annual Convention in Chicago last February marks the last time we were privileged to have him in our midst. We have lost an active worker, a true friend and a fine gentleman who will long be remembered by his host of friends in the crushed stone industry.

Mr. Fulkerson is survived by his wife, the former Ellen Atwater Cross of Carbondale, Pennsylvania; a daughter, Mrs. Charles J. Bishop, of Amarillo, Texas; a son, Stuart H. Fulkerson, of Waverly, Pennsylvania; and a sister, Natalie Fulkerson, of Carbondale, Pennsylvania.

To the members of his family and business associates we extend heartfelt sympathy in their bereavement.

Record Attendance at NCSA Eighth Engineering Conference

(Continued from Page 13)

On Tuesday evening NCSA was host at a dinner for the guest speakers. Both Engineering Director J. E. Gray and Executive Director J. R. Boyd expressed their deep appreciation to the speakers and to their respective organizations for their participation and their contribution toward the success of this Conference. In turn, the speakers noted their pleasure concerning the Conference arrangements and were unanimous in expressing their delight with such a receptive audience.

Thus, we have the factors that made the "Eighth" our most successful Engineering Conference yet—a responsive, attentive audience and well qualified, interesting speakers. Our thanks to all./NCSA

Limestones with Excellent Non-skid Properties

(Continued from Page 11)

residue of the five aggregates studied and it is evident from this curve that there is an excellent correlation. The dashed line on this graph indicates that to obtain a wheel angle of 73 degrees, which is equivalent to a coefficient of friction of 0.4, the limestone aggregate should possess at least eight per cent of sand size particles (0.05 to 2.0 mm) which are of a different hardness than the carbonate fraction of the limestone.

Conclusions

Since this study was conducted on a limited number of limestone aggregates using laboratory means of evaluation, no general conclusions can be drawn. However, it is believed that at least a partial answer to the question of why some limestones polish while others do not has been found. It is known from past tests that blends of limestone aggregate and silica sand in bituminous mixtures can provide surfaces with adequate skid resistance; it is also known that some cherty limestones (nodules) have been used quite satisfactorily in surface course mixtures having good skid resistance; and it is believed that the data presented here strongly indicate that a limestone possessing the properties given above could be used as the entire aggregate in surface course

mixtures which would possess adequate skid resistance. The method of testing limestones for these properties is quite simple although considerable time is required for leaching the coarse particles of aggregate, but it would seem prudent to make such tests rather than reject some good material simply because it carries the name limestone.

It is hoped that these data and this discussion will stimulate others to make a more careful study of the properties of limestones to insure that the best possible use is made of available aggregates./NCSA

Cover Photographs Wanted for the Crushed Stone Journal

Member companies of the National Crushed Stone Association are invited to submit photographs of their quarry operations for use on the covers of the 1961 issues of the Crushed Stone Journal, the Association's official publication.

To each member company submitting a photograph, which is used on the cover of a Journal, NCSA will present a beautiful enlargement suitable for framing.

Experience indicates that the best photographic results are obtained during the morning hours when the air is clear.

All photographs should meet the following requirements:

1. Photographs must be black and white glossy prints of an NCSA member's quarry
2. Photographs should feature the quarry face; or, if an aerial view, must be readily identifiable as a crushed stone quarry
3. Photographs must be clear and sharp with good light and dark contrast and of good composition
4. Photographs should be vertical shots or suitable for cropping

All photographs should be sent to the National Crushed Stone Association, 1415 Elliot Place, N.W., Washington 7, D. C. If your photographs are not used they will be returned promptly./NCSA

Manufacturers Division National Crushed Stone Association

•

These associate members are morally and financially aiding the Association in its efforts to protect and advance the interests of the crushed stone industry. Please give them favorable consideration whenever possible.

•

Acme-Hamilton Mfg. Corp.

Mead St., Trenton 3, N. J.
Conveyor, Elevator and Transmission Belting,
All Types of Industrial Hose and Sheet
Packings

Allis-Chalmers Mfg. Co.

Milwaukee 1, Wis.
Crushing, Screening, Washing, Grinding, Cement and Minerals Processing Machinery;
Motors; Centrifugal Pumps; Air Compressors; Hauling Equipment; Engines; Tractors

American Cyanamid Co.

Explosives and Mining Chemicals Dept.

30 Rockefeller Plaza, New York 20, N. Y.
Explosives, Blasting Supplies, Mining Chemicals

American Manganese Steel Division

American Brake Shoe Co.

155 North Wacker Drive, Chicago 6, Ill.
Manganese and Alloy Steel Castings, Power Shovel Dippers, Material Handling Pumps, Reclamation and Hard-Facing Welding Materials

American Pulverizer Co.

1249 Macklind Ave., St. Louis 10, Mo.
Ring Crushers and Hammermills for Primary and Secondary Crushing and Laboratory Sizes

Atlas Powder Co.

Wilmington 99, Del.
Industrial Explosives and Blasting Supplies

Austin Powder Co.

458 Rockefeller Bldg., Cleveland 13, Ohio
Explosives and Blasting Supplies

Automotive Hardware Co., Inc.

7030 West Roosevelt Road, Oak Park, Ill.
Complete Line of Fasteners (For the Maintenance and Production of All Equipment);
Screws, Nuts, Bolts, Brass Fittings, etc.

Bacon-Greene & Milroy

Division W. H. Milroy & Co., Inc.

P. O. Box 5097, Hamden 18, Conn.
Complete Crushing, Screening, and Washing Plants "From Feeder Through Bin Gate,"
Farrel-Bacon Crushers for Primary and Secondary Operations, Feeders, Belt Conveyors, Bucket Elevators, Screens, Washing and Classifying Equipment, Wire Cloth, Drop Balls, Complete Plant Design

Baldwin-Lima-Hamilton Corp.

Construction Equipment Division

South Main St., Lima, Ohio
Power Shovels, Draglines, Cranes, Tractor Loaders, Bins, Conveyors, Crushers, Feeders, Plants—Crushing and Portable, Washing Equipment, Asphalt Plants, Dust Control Equipment, Vibratory Compactors

Barber-Greene Co.

400 North Highland Ave., Aurora, Ill.
Portable and Permanent Belt Conveyors, Belt Conveyor Idlers, Bucket Loaders, Asphalt Mixing Plants and Finishers, Bucket Elevators, Screens, Portable Screening Plants, Stabilization Mixers, Car Unloaders

Berlin Construction Co., Inc.

Depot Road, Berlin, Conn.
Bins, Chutes, Belt Conveyor Supports and Frames; Plant Design and Layout; Erection of Conveyors, Bins, Crushers, Screens and Supports

Manufacturers Division – National Crushed Stone Association (continued)

Birdsboro-Buchanan Crusher Dept. Birdsboro Corp.

1941 Furnace St., Birdsboro, Pa.
Primary and Secondary Crushers and Rolls

Brunner & Lay-Southern, Inc.

P. O. Box 5235, Asheville, N. C.
Tungsten Carbide Detachable Bits, "Rock Bit"
Drill Steel Inlaid with Tungsten Carbide,
Carbon Hollow Drill Steel, Alloy Hollow
Drill Steel

Bucyrus-Erie Co.

South Milwaukee, Wis.
Excavating, Drilling, and Material Handling
Equipment

Buffalo Springfield Co. Division of Koehring Co.

1210 Kenton St., Springfield, Ohio
Drilling Machines: Rotary Air Drills, Churn
Drills, Rotary Tools, Rotary Bits, Down-the-
Hole Guns, Insert Type Bits, Water Well
Drills

Canadian Industries Ltd.

P. O. Box 10, Montreal, Quebec, Canada
Commercial Explosives and Blasting Acces-
sories

Cape Ann Anchor & Forge Co.

P. O. Box 360, Gloucester, Mass.
"Cape Ann" Forged Steel Drop Balls

Caterpillar Tractor Co.

Peoria 8, Ill.
Track-Type Tractors, Bulldozers, Earthmoving
Scrapers, Motor Graders, Heavy-Duty Off-
Road Hauling Units, Diesel Engines, Diesel
Electric Generating Sets, Front End Shovels,
Wheel-Type Tractors

Chain Belt Co.

P. O. Box 2022, Milwaukee 1, Wis.
Rex Conveyors: Belt, Chain, Vibrating Types;
Elevators; Feeders: Apron, Belt, Drag
Chain, Reciprocating, Rotary, Vibrating;
Idlers; Pulleys; Elevator Buckets; Drive and
Conveyor Chains; Sprockets; Bearings; Pil-
low Blocks; Power Transmission Equipment;
Portable Self-Priming Pumps; Concrete
Mixing and Placing Equipment; Forms and
Shoring; Bins and Gates; Screens; Vibrating
Grizzlies; Iron Castings

Church, H. F., Inc.

P. O. Box 72, Farmington, Conn.
Contract Drilling; Quarry Blast Holes

Clark Equipment Co. Construction Machinery Division

P. O. Box 599, Benton Harbor, Mich.
Tractor Dozers, Tractor Scrapers, Tractor
Shovels, Tractor Wagons; Truck and Crawler
Excavator-Cranes

Continental Conveyor & Equipment Co.

P. O. Box 398, Winfield, Ala.
Belt Conveyors, Bucket Elevators and Screw
Conveyors

Contractors and Engineers Magazine

470 Park Ave., South, New York 16, N. Y.
Magazine of Modern Construction

Cross Perforated Metals Plant National-Standard Co.

P. O. Box 507, Carbondale, Pa.
Cross Perforated Steel Segments, Sections,
Decks, for Vibrating, Shaking, Revolving,
and Other Types of Screening Equipment

Cummins Engine Co., Inc.

1000 Fifth St., Columbus, Ind.
Lightweight Highspeed Diesel Engines (60-600
Hp) for: On-Highway Trucks, Off-Highway
Trucks, Tractors, Earthmovers, Shovels,
Cranes, Industrial and Switcher Locomo-
tives, Air Compressors, Centrifugal Pumps,
Generator Sets and Power Units, Work
Boats, Motor Graders

Deister Machine Co.

1933 East Wayne St., Fort Wayne 4, Ind.
Deister Vibrating Screens, Classifiers, Washing
Equipment

Detroit Diesel Engine Division General Motors Corp.

13400 West Outer Drive, Detroit 28, Mich.
GM Diesel—All Purpose Power Line of Light
Weight, 2 Cycle in Line and "V" Type
Diesels (20 to 1650 Hp in Only 3 Cylinder
Sizes) for On- and Off-Highway Trucks;
Tractors; Earthmoving and Construction
Equipment; Electric Generator Sets; Indus-
trial Power Units

Manufacturers Division – National Crushed Stone Association (continued)

Diamond Iron Works

Division Goodman Manufacturing Co.

Halsted St. and 48th Place, Chicago 9, Ill.

Jaw and Roll Crushers; Vibrator, Revolving, and Scrubber Screens; Drag Washers; Bucket Elevators; Belt Conveyors; Bins; Apron and Plate Feeders; Portable Gravel and Rock Crushing, Screening, and Washing Plants; Stationary Crushing, Screening, and Washing Plants; Hammermills

Eagle Iron Works

P. O. Box 934, Des Moines 4, Iowa

Fine Material Screw Washers—Classifiers—Dehydrators; Coarse Material Screw and Log Washers—Dewaterers; Water Scalping and Fine Material Classifying Tanks; Stabilized Base Material Mixers; Drop Balls—Ni-Hard and Semi-Steel; "Swintek" Screen Chain Cutter Dredging Ladders; Revolving Cutter Head Dredging Ladders

Differential Co.

P. O. Box 238, Findlay, Ohio

Side Dump "Wagon Trains", Mine Cars, Locomotives, Car Dumpers

Easton Car & Construction Co.

Easton, Pa.

Off-Highway Transportation: Quarry Hauling Systems—Heavy-Duty Dump Trailers, Truck Bodies, and Cars for Mines, Quarries, and Earth Moving

Dixon Supply Co.

3104 Fourth Ave., South, Birmingham 5, Ala.

Conveyors—Belt

Electric Steel Foundry Co.

2141 N. W. 25th Ave., Portland 10, Oreg.

Esco Dragline Buckets, Shovel Dippers, Bucket Teeth, Crusher Wearing Parts, Cutting Edges and End Bits

Drill Carrier Corp.

P. O. Box 628, Salem, Va.

"Air-Trac" Drill Carrier

Ensign-Bickford Co.

660 Hopmeadow St., P. O. Box 308, Simsbury, Conn.

Primacord-Bickford Detonating Fuse and Safety Fuse

Du Pont of Canada Ltd.

85 Eglinton Ave., East, Toronto 12, Ontario, Canada

Explosives and Blasting Supplies

Du Pont, E. I., de Nemours & Co.

Wilmington 98, Del.

Explosives and Blasting Supplies

Euclid Division

General Motors Corp.

1361 Chardon Road, Cleveland 17, Ohio

Heavy-Duty Trucks and Dump Trailers for "Off-Highway" Hauls, Loaders for Earth Excavation, Single and Twin Engine Earth Moving Scrapers, Crawler Tractors

Dustex Corp.

25 Anderson Road, Buffalo 25, N. Y.

Dust Collecting Equipment; Dust Control Systems; Feeders

Frog, Switch & Mfg. Co.

Manganese Steel Dept.

Carlisle, Pa.

"Indian Brand" Manganese Steel Castings for All Types of Jaw, Gyratory, and Pulverizing Crushers; Dippers, Teeth, Treads, and Other Parts for Power Excavating Equipment; Other Miscellaneous Manganese Steel Castings; Railroad and Mine Frogs, Switches, Crossings

Eagle Crusher Co., Inc.

900 Harding Way East, Galion, Ohio

Crushers; Pulverizers; Hammermills; 4-Cage Disintegrating Mills; Portable Crushing Plants

Manufacturers Division – National Crushed Stone Association
(continued)

Gardner-Denver Co.

South Front St., Quincy, Ill.

Portable and Stationary Compressors, Rock Drills, "Air-Tracs," Self-Propelled Drills, Portable Rotary Drills, Sectional Drill Rods and Accessories, Air Hoists, Slusher Hoists, "Mole-Drills," Paving Breakers, Drill Steel, Gads, etc.

General Electric Co.

Locomotive & Car Equipment Dept.

2901 East Lake Road, Erie 1, Pa.

Electrical Apparatus, Locomotives

Geophysical Specialties Co.

15409 Robinwood Drive, Hopkins, Minn.

Miniature Engineering Seismograph—Model, MD-1—for Use in Locating and Mapping Sub-Surface Rock Topography

Gill Rock Drill Co., Inc.

P. O. Box 251, Lebanon, Pa.

Well Drill Tools and Supplies

Gilson Screen Co.

110 Center St., Malinta, Ohio

Gilson Testing Screen, Gilson "Porta-Screen," Accessories for Test Sizing of Concrete Aggregates

Goodrich, B. F., Industrial Products Co.

500 South Main St., Akron 18, Ohio

Industrial Rubber Products—Belting (Conveyor, Elevator, Transmission), V-Belts, Hose (Air, Water, Steam, Suction, Misc.); Rubber Chute Lining; Storage Batteries (Automobile, Truck, Tractor); Tires (Automobile, Truck, Off-the-Road); Tubes (Automobile, Truck, Off-the-Road); Industrial Tires and Tubes

Goodyear Tire & Rubber Co.

Akron 16, Ohio

Airfoam; Industrial Rubber Products—Belting (Conveyor, Elevator, Transmission); Hose (Air, Water, Steam, Suction, Miscellaneous); Chute Lining (Rubber); Rims (Truck, Tractor); Storage Batteries (Automobile, Truck, Tractor); Tires (Automobile, Truck, Off-the-Road); Tubes (Automobile, Truck, Off-the-Road)

Gulf Oil Corp.

P. O. Box 1166, Pittsburgh 30, Pa.

Lubricating Oils, Greases, Gasoline and Diesel Fuels

Hardinge Co., Inc.

240 Arch St., York, Pa.

Process Equipment for Grinding, Pulverizing, Drying, Thickening, Classifying, Feeding, Calcining, Cooling, Washing

Harnischfeger Corp.

4400 West National Ave., Milwaukee 46, Wis.

Complete Line of Power Cranes, Shovels, Draglines, Overhead Cranes, Hoists, Welders, Electrodes, Generators, Diesel Engines

HarriSteel Products Co.

420 Lexington Ave., New York 17, N. Y.

Woven Wire Screen Cloth

Heidenreich, E. Lee, Jr.

Consulting Engineers

75 Second St., Newburgh, N. Y.

Plant Layout, Design, Supervision; Open Pit Quarry Surveys; Appraisals—Plant and Property

Hendrick Mfg. Co.

Carbondale, Pa.

Perforated Metal Screens, Perforated Plates for Vibrating, Shaking, and Revolving Screens; Elevator Buckets; Test Screens; Wedge Slot Screens; Wedge Wire Screens; Open Steel Floor Grating

Hercules Powder Co.

Wilmington 99, Del.

Explosives and Blasting Supplies

Hetherington & Berner, Inc.

701-745 Kentucky Ave., Indianapolis 7, Ind.

Asphalt Paving Machinery, Sand and Stone Dryers

Manufacturers Division — National Crushed Stone Association

(continued)

Hewitt-Robins Incorporated

666 Glenbrook Road, Stamford, Conn.

Belt Conveyors (Belting and Machinery); Belt and Bucket Elevators; Car Shakeouts; Feeders; Industrial Hose; Screen Cloth; Sectional Conveyors; Skip Hoists; Stackers; Transmission Belting; Vibrating Conveyors, Feeders, and Screens; Design and Construction of Complete Plants; Molded Rubber Goods; Sheet Packing; Transmission Belting; De-waterizers; Wire Conveyor Belts; Speed Reducers; Gears; Pulleys; Sheaves; Couplings

Hoyt Wire Cloth Co.

P. O. Box 1577, Lancaster, Pa.

Aggregate Wire Screens Made of Supertough, Abraso, and Stainless Steel Wire—Smooth-top, Longslot, Oblong Space, and Double Crimp Construction—For All Makes of Vibrators; Rubber Bucker Up Channel

Hughes Tool Co.

P. O. Box 2539, Houston 1, Texas

Bits—Rotary Rock

Ingersoll-Rand Co.

11 Broadway, New York 4, N. Y.

Rock Drills, Paving Breakers, Paving Breaker Accessories, Quarrymaster Drills, Drillmasters, Waterwell Drills, Down-Hole Drills, Crawl-ir Drills and Wagon Drills, Carset Bits, Jackbits, Bit Reconditioning Equipment, Portable and Stationary Air Compressors, Air Hoists, Slusher Hoists, Pneumatic Tools, Centrifugal Pumps, Diesel and Gas Engines, Blowers and Fans

International Harvester Co.

Construction Equipment Division

P. O. Box 270, Melrose Park, Ill.

Crawler Tractors and Equipment, Rubber Tired Scrapers and Bottom Dump Wagons, Off-Highway Dump Trucks, Carbureted and Diesel Power Units

Iowa Manufacturing Co.

916 16th St., N. E., Cedar Rapids, Iowa

Rock and Gravel Crushing, Screening, Conveying and Washing Plants, Asphalt Plants, Stabilizer Plants, Impact Breakers, Screens, Elevators, Conveyors, Portable and Stationary Equipment, Hammermills, Bins

Jaeger Machine Co.

550 West Spring St., Columbus 16, Ohio

Portable and Stationary Air Compressors, Self-Priming Pumps, Truck Mixers, Concrete Mixers, Road Paving Machinery, Hoists and Towers; Finishers—Concrete; Spreaders—Stone and Concrete; Truck Mixers—Concrete

Jaques Bros. Ltd.

Griffiths & Palmer Sts., Richmond, Victoria, Australia

Crushers, Pulverizers; Elevators; Feeders; Plants—Stationary, Portable; Screens—Vibrating, Shaking, Revolving; Shovels, Draglines, Cranes, Clamshells

Jeffrey Manufacturing Co.

815 North Fourth St., Columbus 16, Ohio

Elevator Buckets; Car Pullers; Chains; Conveyors: Belt, Drag, Apron, Vibrating; Idlers; Crushers; Pulverizers; Elevators; Feeders; Pillow Blocks; Grizzlies; Screens

Joy Manufacturing Co.

333 Henry W. Oliver Bldg., Pittsburgh 22, Pa.

Drills: Blast-Hole, Wagon, Rock, and Core; Air Compressors: Portable, Stationary, Semi-Portable; Aftercoolers; Portable Blowers; Carpullers; Hoists; Multi-Purpose, Portable; Rock Loaders; Air Motors; Trench Diggers; Belt Conveyors; "Spaders;" "String-a-Lite" (Safety Lighting Cable); Backfill Tampers; Drill Bits; Rock Core; Joy Microdyne Dust Collectors

Kennedy Van Saun Mfg. & Eng. Corp.

405 Park Ave., New York 22, N. Y.

Crushing, Screening, Washing, Conveying, Elevating, Grinding, Complete Cement Plants, Complete Lime Plants, Complete Lightweight Aggregate Plants, Synchronous Motors, Air Activated Containers for Transportation of Pulverized Material, Cement Pumps, and Power Plant Equipment

Kensington Steel Division

Poor & Co., Inc.

505 East Kensington Ave., Chicago 28, Ill.

Oro Alloy and Manganese Steel Castings; For Shovels—Dipper Teeth, Crawler Treads, Rollers, Sprockets; For Crushers—Jaw Plates, Concaves, Concave Rings, Mantles; For Pulverizers—Hammers, Grate Bars, Liners; For Elevators and Conveyors—Chain, Sprockets, Buckets; For Tractors—Sprocket Rims, Grouser Plates; Drag Line Chain

Manufacturers Division – National Crushed Stone Association
(continued)

**Koehring Division
Koehring Co.**

3026 West Concordia Ave., Milwaukee 16, Wis.
Excavating, Hauling, and Concrete Equipment

LeTourneau-Westinghouse Co.

2301 North Adams St., Peoria, Ill.
Earthmoving Equipment, Motor Graders, Off-Highway Trucks, Wire Rope

Link-Belt Co.

300 West Pershing Road, Chicago 9, Ill.
Complete Stone Preparation Plants; Conveyors, Elevators, Screens, Washing Equipment, and Power Transmission Equipment

Link-Belt Speeder Corp.

1201 Sixth St., S. W., Cedar Rapids, Iowa
Complete Line of Speed-o-Matic Power Hydraulically Controlled Cranes, Shovels; Hoes, Draglines, and Clamshells, 1/2 to 3-Yd Capacities; Available on Crawler Base or Rubber Tire Mounting; Diesel Pile Hammers

Lippmann Engineering Works, Inc.

4603 West Mitchell St., Milwaukee 14, Wis.
Primary and Secondary Rock Crushers and Auxiliary Equipment such as Feeders, Screens, Conveyors, etc., Portable and Stationary Crushing and Washing Plants

Ludlow-Saylor Wire Cloth Co.

4333 West Clayton Ave., St. Louis 10, Mo.
Woven Wire Screens of Ludlow, 'Oil Tempered'; Super-Loy (Hi-Carb); Steel; Stainless Steel; All Other Commercial Alloys

Mack Trucks, Inc.

1355 West Front St., Plainfield, N. J.
4- and 6-Wheeled Trucks and Tractors—Gasoline- and Diesel-Powered from 5 to 12 Cu Yd Capacity with a Wide Choice of Transmissions and Front and Rear Axles with 2-, 4-, and 6-Wheel Drives; 4- and 6-Wheeled Off-Highway Vehicles from 15- to 40-Ton Capacity with Diesel Power Plants Available from 170 to 400 Hp

Manganese Steel Forge Co.

Richmond St. and Castor Ave., Philadelphia 34, Pa.
Rol-Man 11.00 to 14.00 Per Cent Rolled Manganese Steel Woven and Perforated Screens, and Fabricated Parts for Aggregate Handling Equipment

**Marion Power Shovel Co.
Division of Universal Marion Corp.**

617 West Center St., Marion, Ohio
Power Shovels, Draglines, Cranes, Truck Cranes—From 3/4 to 75 Yd

Marsh, E. F., Engineering Co.

4324 West Clayton Ave., St. Louis 10, Mo.
Belt Conveyors

Mayhew Supply Co., Inc.

4700 Scyene Road, Dallas 17, Texas
Blast Hole Drill Rigs

McLanahan & Stone Corp.

252 Wall St., Hollidaysburg, Pa.
Complete Pit, Mine, and Quarry Equipment—Crushers, Washers, Screens, Feeders, etc., Semi-Portable Plants

Meissner Engineers, Inc.

300 West Washington St., Chicago 6, Ill.
Engineers—Constructors—Specialists in Plant Layout, Construction-Engineering Design, Procurement, Construction Management, Quarry Surveys, Plant and Property Appraisals

Murphy Diesel Co.

5317 West Burnham St., Milwaukee 19, Wis.
Engines—Industrial Engine, and Power Units for Operation on Diesel and Dual Fuel Engines. Generator Sets, AC and DC from 64 to 165 kw. Mech-Elec Unit—Combination Mechanical and Electric Power Furnished Simultaneously

New Jersey Drilling Co., Inc.

Box 251, Route 206, Netcong, N. J.
Contract Drilling; Quarry Blast Holes

New York Rubber Corp.

100 Park Ave., New York 17, N. Y.
Conveyor Belting: Stonore, Dependable, and Cameo Grades; Transmission Belting: Silver Duck Duroflex, Soft Duck Rugged, Commercial Grade Tractor

Manufacturers Division – National Crushed Stone Association (continued)

Nordberg Mfg. Co.

3073 South Chase Ave., Milwaukee 1, Wis.
Symons Cone Crushers, and Symons Gyratory and Impact Crushers; Gyradisc Crushers; Grinding Mills; Stone Plant and Cement Mill Machinery; Vibrating Screens and Grizzlies; Diesel Engines and Diesel Generator Units; Mine Hoists; Railway Track Maintenance Machinery

Northern Blower Division Buell Engineering Co., Inc.

6409 Barberton Ave., Cleveland 2, Ohio
Dust Collecting Systems, Fans—Exhaust and Blower

Northwest Engineering Co.

135 South LaSalle St., Chicago 3, Ill.
Shovels, Cranes, Draglines, Pullshovels—Crawler and Truck Mounted

Olin Mathieson Chemical Corp. Energy Division

East Alton, Ill.
Explosives, Blasting Caps, Blasting Accessories

Pennsylvania Crusher Division Bath Iron Works Corp.

323 South Matlack St., West Chester, Pa.
Single Roll Crushers, Impactors, Reversible Hammermills, Ring Type Granulators, Kue-Ken Jaw Crushers, Kue-Ken Gyratories, Non-Clog and Standard One-Way Hammermills

Pettibone Mulliken Corp.

4710 West Division St., Chicago 51, Ill.
Tractor Shovels, Front End Loaders, Swing Loaders, Yard Cranes, Bucket and Fork Loaders, Motor Graders, Manganese Steel Castings, Material Handling Buckets, Clamshells, Draglines, Pull Shovel Dippers, Shovel Dippers, and Pumps

Pioneer Engineering Division of Poor & Co., Inc.

3200 Como Ave., Minneapolis 14, Minn.
Jaw Crushers, Roll Crushers (Twin and Triple), Impact Crushers, Hammer-Mills, Vibrating and Revolving Screens, Feeders (Reciprocating, Apron, and Pioneer Oro Manganese Steel), Belt Conveyors, Idlers, Accessories and Trucks, Portable and Stationary Crushing and Screening Plants, Washing Plants, Mining Equipment, Cement and Lime Equipment, Asphalt Plants, Mixers, Dryers, and Pavers

Pit and Quarry Publications, Inc.

431 South Dearborn St., Chicago 5, Ill.
Pit and Quarry, Pit and Quarry Handbook, Pit and Quarry Directory, Modern Concrete, Concrete Industries Yearbook, Equipment Distributor's Digest

Productive Equipment Corp.

2926 West Lake St., Chicago 12, Ill.
Vibrating Screens

REICHdrill Division Chicago Pneumatic Tool Co.

6 East 44th St., New York 17, N. Y.
Air Compressors, Rock Drills, Diesel Engines, Pneumatic Tools, Rotary and "Down-the-Hole" Drilling Machines for Exploration, Coring, Blast Holes

Rock Products

79 West Monroe St., Chicago 3, Ill.
Publications: Rock Products and Concrete Products

Rogers Iron Works Co.

11th and Pearl Sts., Joplin, Mo.
Jaw Crushers, Roll Crushers, Hammermills, Vibrating Screens, Revolving Screens and Scrubbers, Apron Feeders, Reciprocating Feeders, Roll Grizzlies, Conveyors, Elevators, Portable and Stationary Crushing and Screening Plants, Mine Hoists, Drill Jumbos, Underground Loaders, Iron Castings, Screw Washers, and Classifying Tanks

Schramm, Inc.

West Chester, Pa.
Air Compressors: Portable and Stationary, Gasoline, Diesel, and Electric Driven; Boosters; Pneumattractors, Self-Propelled; Accessories; Bits—Rock; Rotatool Bits, Carbide Insert; Drills, Drilling Equipment; Rotadrills Mounted on Pneumattractors, Trucks and Crawlers; Ready-to-Mount Rotadrills for Mounting on Used Trucks and Crawler Tractors; Rotatools for Bottom-Hole Drilling; Rock Drills; Wagon Drills; Breakers; Accessories

Manufacturers Division – National Crushed Stone Association
(continued)

Screen Equipment Co., Inc.

40 Anderson Road, Buffalo 25, N. Y.
Seco Vibrating Screens; Scales—Industrial, Aggregates, Truck

Simplicity Engineering Co.

Durand, Mich.
Simplicity Gyration Screens, Horizontal Screens, Simpli-Flo Screens, Tray Type Screens, Heavy Duty Scalpers, D'Watering Wheels, D'Centegrators, Vibrating Feeders, Vibrating Pan Conveyors, Car Shake-Outs, Woven Wire Screen Cloth, Grizzly Feeders

**Smith Engineering Works
Division Barber-Greene Co.**

P. O. Box 723, Milwaukee 1, Wis.
Gyratory, Gyrasphere, Jaw and Roll Crushers, Vibrating and Rotary Screens, Gravel Washing and Sand Settling Equipment, Elevators and Conveyors, Feeders, Bin Gates, and Portable Crushing and Screening Plants

Stedman Foundry & Machine Co., Inc.

P. O. Box 209, Aurora, Ind.
Stedman Impact-Type Selective Reduction Crushers, 2-Stage Swing Hammer Limestone Pulverizers, Multi-Cage Limestone Pulverizers, Vibrating Screens

Stephens-Adamson Mfg. Co.

Ridgeway Ave., Aurora, Ill.
Belt Conveyors, Pan Conveyors, Bucket Elevators, "Amsco" Manganese Steel Pan Feeders, Vibrating Screens, Belt Conveyor Carriers, Bin Gates, Car Pullers, "Sealmaster" Ball Bearing Units, "Saco" Speed Reducers, and Complete Engineered Stone Handling Plants

**Taylor-Wharton Co.
Division Harsco Corp.**

High Bridge, N. J.
Manganese and Other Special Alloy Steel and Iron Castings; Dipper Teeth, Fronts and Lips; Crawler Treads; Jaw and Cheek Plates; Mantles and Concaves; Pulverizer Hammers and Liners; Asphalt Mixer Liners and Tips; Manganese Nickel Steel Welding Rod and Plate; Elevator, Conveyor, and Dredge Buckets; Pan Feeders

Thew Shovel Co.

East 28th St. and Fulton Road, Lorain, Ohio
"Lorain" Power Shovels, Cranes, Draglines, Clamshells, Hoes on Crawlers and Rubber Tire Mountings; Diesel, Electric, and Gasoline, 3/8 to 2 1/2 Yd Capacities; "Lorain" Motor-Loader—Rubber Tire Front End Loader 1 3/4 and 2 Yd Capacity

Thor Power Tool Co.

175 North State St., Aurora, Ill.
Crawler and Hand-Held Rock Drills, Sump and Sludge Pumps, Clay Diggers, Paving Breakers, Quarry Bars, Sinkers Legs, Drifters, Rock Drilling Jumbos, Raiser Legs, Push Feed Rock Drills, Air and Electric Tools, Accessories, Generator Sets, Concrete Vibrators, Power Trowels, Vibratory Screeds

**Timken Roller Bearing Co.
Service-Sales Division**

1835 Dueber Ave., S. W., Canton 6, Ohio
"Timken"—Tapered Roller Bearings; Alloy Steel; Rock Bits

**Torrington Co.
Bantam Bearings Division**

3702 West Sample St., South Bend 21, Ind.
Anti-Friction Bearings; Self-Aligning Spherical, Tapered, Cylindrical, and Needle Roller; Roller Thrust; Ball Bearings

**Traylor Eng. & Mfg.
Division of Fuller Co.**

Allentown, Pa.
Stone Crushing, Gravel, Lime, and Cement Machinery

Trojan Powder Co.

17 North Seventh St., Allentown, Pa.
Explosives and Blasting Supplies

Tyler, W. S., Co.

3615 Superior Ave., N. E., Cleveland 14, Ohio
Woven Wire Screens; Ty-Rock, Tyler-Niagara and Ty-Rocket (Mechanically Vibrated) Screens; Hum-mer Electric Screens; Ro-Tap Testing Sieve Shakers, Tyler Standard Screen Scale Sieves, U. S. Sieve Series

Manufacturers Division – National Crushed Stone Association

(continued)

Universal Engineering Corp.

Subsidiary of Pettibone Mulliken Corp.

625 C Ave., N. W., Cedar Rapids, Iowa

Crushers—Jaw, Roll, TwinDual Roll; Hammermills, Impact Breakers, Pulverizers, Bins, Conveyors, Feeders, Screens, Scrubbers. Bulldog Non-Clog Moving Breaker Plate and Stationary Breaker Plate Hammermills, Center Feed Hammermills. Complete Line of Stationary and Portable Crushing, Screening, Washing, and Loading Equipment for Rock, Gravel, Sand, Ore; Aglime Plants; Asphalt Plants

Varel Manufacturing Co.

9230 Denton Drive, Dallas 20, Texas

Rock Bits, Drilling; Bits: Diamond, Blade, Drag

Vibra-Tech Engineers, Inc.

407 Hazleton National Bank Bldg., Hazleton, Pa.

Consultants on Vibration and Blast Effects; Seismograph Sales, Rental and Record Interpretation; Pre-Blast and Post-Blast Property Inspections; Seismic and Resistivity Rock Depth Surveys; Rock Velocity Measurements

Vibration Measurement Engineers, Inc.

725 Oakton St., Evanston, Ill.

Seismographic and Airblast Measurements, Seismological Engineering, Blasting Complaint Investigations, Expert Testimony in Blasting Litigation; Complete Seismograph Rental and Record Analysis Service with "Seismolog"

Webb, Jervis B., Co.

8951 Alpine Ave., Detroit 4, Mich.

Design and Construction of Complete Material Handling Systems; Conveyors—Belt and Flight; Bucket Elevators; Feeders; Forged Chain

Werco Steel Co.

2151 East 83rd St., Chicago 17, Ill.

Castings—Manganese, Alloy Steel; Screen Plates—Perforated Steel Screen Sections and Decks; Buckets; Chains; Belt Conveyors, Idlers; Dipper—Shovel; Drop Balls; Wire Cloth; Wire Rope and Related Products; Crushers, Pulverizers

Western-Knapp Engineering Co.

50 Church St., New York 7, N. Y.

Plant Design and Construction Operating Studies; Appraisals

White Motor Co.

842 East 79th St., Cleveland 1, Ohio

On- and Off-Highway Trucks and Tractors—Gasoline- and Diesel-Powered; Industrial Engines—Gasoline and Diesel; Power Units, Axles, Special Machine Assemblies; Power Generating and Distributing Systems; Batteries; All Classes of Maintenance and Repair Service

White Motor Co.

Autocar Division

Exton, Pa.

Custom Engineered, Precision Built Trucks and Tractors for On- or Off-Highway: Gasoline or Diesel Powered, 2 or 3 Axles, Single Axle to All Axle Drives; Planetary Gear Driven Vehicles for Quarry, Mine, and Construction Operations

Wickwire Spencer Steel Division Colorado Fuel and Iron Corp.

575 Madison Ave., New York 22, N. Y.

Wire Cloth, Screens, Screen Sections, Wire Rope—Slings

Williams Patent Crusher & Pulverizer Co.

2701-2723 North Broadway, St. Louis 6, Mo.

Hammer Mills, Crushers, Pulverizers, Roller Mills, Reversible Impactors, Vibrating Screens, Air Separators, Bins, Feeders

Wiss & Associates

570 Northwest Highway, Des Plaines, Ill.

Seismological Engineers

